

# SCALPEL DEVELOPMENT PROGRAM

## CONTRACT DELIVERABLE A006: Quarterly R&D Status and Management Report

December 1, 1994-February 28, 1995

AT&T Bell Laboratories  
Murray Hill, New Jersey  
March 1, 1995

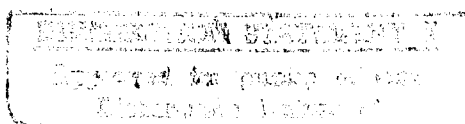
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## Fourth Quarter R&D Status and Management Report

**Reporting Period:** December 1, 1994 - March 1, 1995

### Progress During the Reporting Period:

#### Task 1.1. System Engineering And Modeling

To complete the Preliminary System Modeling, progress in Task 1 this quarter has involved the definition and compilation of the preliminary system error budget.

In order to analyze the SCALPEL System in terms of the error budget two main issues must be addressed: identification of error sources and relationship between component errors and lithographic quality. In A008, Section II which is submitted concurrently with this document, we report the results of this study. We conclude that the System Design is compatible with critical dimension values as small as 90 nm.

#### Task 1.2. Basic Concept Evaluation Experiments

To complete the Basic Concept Evaluation Experiments, our primary goal for this quarter and this task was to combine our analysis of the proximity effect

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correction with the resist properties determined in SOW 1.5.3 (CDRL A005) and analyze their combined effects on critical dimension control. Using an ideal "step function" resist exposure curve, the linewidth variation of three basic features (isolated space, isolated line and equal line and space patterns) has been examined as a function of exposure dose. In this report, these calculations are described in detail and are combined with actual resist characteristics to understand the relationship between dose and linewidth control in a more realistic resist processing model. This work is reported in A008, Section III which is submitted concurrently with this document.

#### Task 1.3. Design of Proof-of-Concept System

The test stand design including vacuum enclosure, electronics, software and stages is essentially complete (SOW 1.3.3). In accordance with the Contract Modification P00001 the design will now be constructed and an initial evaluation delivered to ARPA.

A description of the design and the specifications are given in A008, Section IV which is submitted concurrently with this document.

#### Task 1.4.Mask Development

The final piece of work in Task 4 was to evaluate the mechanical properties of the mask blanks (SOW 1.4.6) using the mechanical properties test stand described in A008 (Q1).

Unpatterned mask membranes are made to experience a differential pressure and hence undergo deformation. The amount of deformation is measured up to and including the point of catastrophic failure. An analysis is performed to extract the mechanical characteristics of the mask blanks. This work is reported in CDRL A004 which is submitted concurrently with this document.

#### Task 1.5. Resist Development

To complete the Resist Development Task (SOW 1.5) we have analyzed the performance characteristics and pre and post exposure requirements for the candidate resist material.

The material was exposed in an electron beam lithography system and its response analyzed in terms of sensitivity to post exposure issues such as environment and bake temperature. This work is reported in A008, Section V which is submitted concurrently with this document.

#### **Planned Activities and Milestones for Next Reporting Period:**

##### Task 1.1. System Engineering And Modeling

No activity, this task is complete

##### Task 1.2. Basic Concept Evaluation Experiments

No activity, this task is complete



Task 1.3. Design of Proof-of-Concept System

We will continue with construction of the SCALPEL Proof of Concept electron gun and motion system as per Contract Modification P00001.

Task 1.4.Mask Development

No activity, this task is complete

Task 1.5. Resist Development

No activity, this task is complete

**Equipment Purchased or Constructed During the Period:**

We have neither purchased nor constructed any major experimental or special equipment during the period.

**Changes in Key Personnel During Period:** R.R. Freeman is no longer assigned to the project. He has been replaced by D.E. Ibbotson.

**Substantive Information Gained From Trips and Conferences:** None

**Summary of Problems or Concerns:** None

**Related Accomplishments Since Last Report:** None



**Report Prepared by**

S.D. BERGER

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**Distribution:**

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